

Amendments of the Claims:

A detailed listing of all claims in the application is presented below. This listing of claims will replace all prior versions, and listings, of claims in the application. All claims being currently amended are submitted with markings to indicate the changes that have been made relative to immediate prior version of the claims. The changes in any amended claim are being shown by strikethrough (for deleted matter) or underlined (for added matter).

1. (Previously Presented): In a hydraulic machine having a plurality of pistons reciprocally mounted in respective cylinders formed in a cylinder block and positioned circumferentially at a first radial distance about the rotational axis of a drive element, each said piston having a an axially cylindrical body portion and a head end and each respective cylinder having a valve end and an open head portion beyond which said head end of each said piston extends at all times, and said pistons also having a stroke varying up to a predetermined maximum for receiving and delivering pressurized fluid, the improvement comprising.
 - a respective lubricating channel formed in the cylindrical wall of each said cylinder in said cylinder block for retaining said pressurized fluid;
 - all of said lubricating channels being interconnected to form a continuous lubricating passageway in said cylinder block;
 - said pressurized fluid being retained in said continuous lubricating passageway by the substantial closure of each said respective lubricating channel by the outer surface of the axially cylindrical body of each respective piston during the entire stroke of each said piston, the only source of pressurized fluid received by said continuous lubricating passageway being a minimal flow of said fluid between each said respective cylindrical wall of each said cylinder and said axial cylindrical body of each respective piston; and
 - said closed continuous lubricating passageway being formed entirely within said cylinder block, transecting each said cylinder and being centered

circumferentially at substantially the same radial distance as said cylinders are centered about the rotational axis of the drive element.

2. (Cancelled)

3. (Original): The hydraulic machine of claim 1 further comprising a sealing member located in proximity to said open head portion of each said cylinder for substantially eliminating blow-by between each said piston and said open head portion of each respective cylinder.

4. (Previously Presented): The hydraulic machine of claim 1 further comprising a clearance between said respective body portions of said pistons and said respective cylinders, the dimensions of said clearance being selected to assure said minimal flow of fluid between each said respective cylindrical wall of each said cylinder and said axial cylindrical body of each respective piston is sufficient to cause movement of lubricating fluid in said closed continuous lubricating passageway upon the occurrence of at least one of (a) piston motion, and (b) changing fluid pressures at said valve end of each respective cylinder.

5. (Previously Presented): The hydraulic machine of claim 1 in combination with a second hydraulic machine according to claim 1, said hydraulic machines being connected to each other in a conventional closed loop of circulating hydraulic fluid wherein high-pressure fluid exiting from the first said hydraulic machine is directly delivered to the second said hydraulic machine, while low-pressure fluid exiting from the second said hydraulic machine is directly delivered to the input of the first said hydraulic machine, and wherein said minimal flow of fluid between each said piston and said valve end of each respective cylinder of both said hydraulic machines to and from said closed continuous lubricating passageway is immediately returned to said closed loop of circulating hydraulic fluid without requiring the use of a charge pump.

6. (Original): The hydraulic machine of claim 1 further comprising a swash-plate with a flat face, said swash-plate having an inclination relative to said rotational axis of the drive element, and wherein said head end of each piston is maintained in effective sliding contact with said flat face of said swash-plate during all relative rotary motions between said pistons

and said swash-plate, said stroke of said pistons being determined in accordance with the inclination of said swash-plate, and said body portion of each piston has an elongated axial cylindrical length sufficient to be supported within said respective cylinder to assure minimal lateral displacement of said head end of said piston when in relative sliding contact with said flat face at all times during said stroke.

7. (Original): The hydraulic machine of claim 6 wherein said cylinder block is fixed in a housing, said swash-plate rotates with said drive element and includes a rotor that rotates and nutates, and said flat face is located on said rotor.

8. (Original): The hydraulic machine of claim 6 wherein said cylinder block is fixed in a housing and said swash-plate has a split design comprising a rotor that rotates and nutates and a wobbler that only nutates, and said flat face is located on said wobbler.

9. (Original): The hydraulic machine of claim 8 wherein the inclination of said swash-plate is variable and the stroke of said pistons varies up to said predetermined maximum in accordance with said inclination.

10. (Original): The hydraulic machine of claim 6 wherein each piston has a spherical head end connected to said body portion by a narrowed neck portion, and said machine further comprises:

- a respective sliding shoe pivotally affixed to said spherical head end of each said respective piston and maintained in effective sliding contact with said flat face of said swash-plate during all relative rotary motions between said pistons and said flat face; and
- a hold-down assembly for biasing said sliding shoes toward said flat face of said swash-plate.

11. (Original): The hydraulic machine of claim 10 wherein said hold-down assembly comprises:

- a hold-down element having a plurality of respective openings, the boundary of each said respective opening in said hold-down plate being located in proximity to said narrowed neck portion of each respective piston; and

- a respective washer fitted about said narrowed neck portion of each piston between said hold-down plate and each respective sliding shoe, each said respective washer having an extension aligned cylindrically for circumferentially contacting each said respective sliding shoe;
- said washers being in sliding contact with said hold-down plate for movement relative thereto in response to the changing relative positions of said sliding shoes when said flat face of said rotor is inclined relative to said rotational axis of the drive element.

12. (Original): The hydraulic machine of claim 11 wherein the boundary of each said respective opening in said hold-down plate is designed to be in contact with more than one-half of the outer circumference of each said respective washer at all times during said relative movements.

13. (Original): The hydraulic machine of claim 11 wherein said machine further comprises a minimal spring bias sufficient to maintain said effective sliding contact between each said respective shoe and said flat face of said swash-plate in the absence of hydraulic pressure at said valve end of each respective cylinder.

14. (Original): The hydraulic machine of claim 13 wherein said minimal spring bias is provided by a coil spring positioned circumferentially about the rotational axis of said drive element at less than said first radial distance for biasing said hold-down plate against said washers.

15. (Original): The hydraulic machine of claim 13 wherein said minimal spring bias is provided by a plurality of springs, each said spring being positioned respectively between said hold-down plate and one of said respective washers.

16. (Original): The hydraulic machine of claim 10 wherein said hold-down assembly comprises only:

- a minimal spring bias sufficient to maintain said effective sliding contact between each said shoe and said flat face of said swash-plate in the absence of hydraulic

pressure at said valve end of each respective cylinder, and said minimal spring bias is provided by a plurality of springs, each said spring being positioned respectively between said body portion of each respective piston and said valve end of each respective cylinder.

17. (Previously Presented): In a hydraulic machine having a plurality of pistons reciprocally mounted in respective cylinders formed in a cylinder block fixed in a housing and positioned circumferentially at a first radial distance about the rotational axis of a drive element, each said piston having a body portion and a head end connected to said body portion, each respective cylinder having a valve end and an open head portion, a split swash-plate driven by said drive element and having a variably-inclined rotor that rotates and nutates and a wobbler that only nutates, and said pistons also having a stroke varying in accordance with the inclination of said swash-plate up to a predetermined maximum, the improvement comprising:

- a flat face located on said wobbler;
- said head end of each said piston being spherical, being connected to said body portion by a narrowed neck portion, and extending at all times beyond said head end of said respective cylinder;
- said body portion of each piston having an elongated axial cylindrical length sufficient to be supported within said respective cylinder to assure minimal lateral displacement of said head end of said piston when said shoe is in relative sliding contact with said flat face at all times during said stroke;
- a respective sliding shoe pivotally and directly affixed to said spherical head end of each said respective piston without any intermediate dog-bone;
- each said respective sliding shoe being maintained in direct sliding contact with said flat face of said wobbler during all relative rotary motions between said piston and said flat face; and

- a hold-down assembly for biasing each said sliding shoe toward said flat face of said wobbler.

18. (Previously Presented): The hydraulic machine of claim 17 wherein said split swash-plate further comprises roller bearings for supporting said nutating-only wobbler on said rotating and nutating rotor.

19. (Previously Presented): The hydraulic machine of claim 17 wherein said hold-down assembly comprises:

- a hold-down element having a plurality of respective openings, the boundary of each said respective opening in said hold-down plate being located in proximity to said narrowed neck portion of each respective piston; and
- a respective washer fitted about said narrowed neck portion of each piston between said hold-down plate and each respective sliding shoe, each said respective washer having an extension aligned cylindrically for circumferentially contacting each said respective sliding shoe;
- said washers being in sliding contact with said hold-down plate for movement relative thereto in response to the changing relative positions of said sliding shoes when said flat face of said rotor is inclined relative to said rotational axis of the drive element.

20. (Previously Presented): The hydraulic machine of claim 19 wherein the boundary of each said respective opening in said hold-down plate is designed to be in contact with more than one-half of the outer circumference of each said respective washer at all times during said relative movements.

21. (Previously Presented): The hydraulic machine of claim 20 wherein said machine further comprises a minimal spring bias sufficient to maintain said effective sliding contact between each said respective shoe and said flat face of said swash-plate in the absence of hydraulic pressure at said valve end of each respective cylinder.

22. (Previously Presented): The hydraulic machine of claim 21 wherein said minimal spring bias is provided by a plurality of springs, each said spring being positioned respectively between said hold-down plate and one of said respective washers.

23. (Previously Presented): In a hydraulic machine having a plurality of pistons reciprocally mounted in respective cylinders formed in a cylinder block and positioned circumferentially at a first radial distance about the rotational axis of a drive element, each said piston having a body portion and a spherical head end connected to said piston body portion by a narrowed neck portion and each respective cylinder having a valve end and an open head portion beyond which said head end of each said piston extends at all times, a swash-plate with a flat face, said swash-plate having an inclination relative to said rotational axis of the drive element, and said head end of each piston being maintained in effective sliding contact with said flat face of said swash-plate during all relative rotary motions between said pistons and said swash-plate, said stroke of said pistons being determined in accordance with the inclination of said swash-plate, and said pistons also having a stroke varying up to a predetermined maximum, the improvement comprising:

- a respective sliding shoe pivotally affixed to said spherical head end of each said respective piston and positioned to contact and slide over said flat face of said swash-plate;
- a hold-down element biased toward said sliding shoes and having a plurality of respective openings, one of said respective openings being located in proximity to said narrowed neck portion of each piston; and
- a respective washer fitted about said narrowed neck portion of each piston between said hold-down plate and each respective sliding shoe, each said respective washer having an extension aligned for contacting each said respective sliding shoe;
- said washers being in sliding contact with said hold-down plate for movement relative thereto in response to the changing relative positions of said sliding shoes

when said flat face of said rotor is inclined relative to said rotational axis of the drive element.

24. (Previously Presented): The hydraulic machine of claim 23 wherein each said respective washer extension is aligned cylindrically for circumferentially contacting each said respective sliding shoe.
25. (Previously Presented): The hydraulic machine of claim 23 wherein the boundary of each said respective opening in said hold-down plate is designed to be in contact with more than one-half of the outer circumference of each said respective washer at all times during said relative movements.
26. (Previously Presented): The hydraulic machine of claim 23 wherein said machine further comprises a coil spring positioned circumferentially about the rotational axis of said drive element at less than said first radial distance for biasing said hold-down plate against said washers.